What is Claimed is:

Sub A1

1. A reaction matrix comprising a waveguide capable of guiding and channeling light and having on the surface of said waveguide a cladding layer having at least one area of depletion wherein a substance placed within said depletion area can be illuminated by the evanescent wave of light channeled in said waveguide.

2. A system for detecting the presence of a target substance comprising:

   a polymer waveguide capable of optically guiding light propagated therethrough, said light propagation comprising an evanescent wave, and

   a cladding layer of material comprising at least one depletion area wherein said cladding layer is in optical communication with said polymer waveguide and said depletion area is in optical communication with said evanescent wave.

3. The system of claim 2 for detecting one member of a pair of binding partners in a test sample wherein said test sample is brought into fluid communication with said depletion area which further comprises the other member of said pair of binding partners.

4. The system of claim 3 wherein the binding of said binding partners can be excited by said evanescent wave which can be detected and related to the presence of said binding partner in the test sample.

5. The system of claim 4 where a fluorescent label is associated with said binding partners such that when a pair of said partners have bound said fluorescent label is excited by the evanescent wave resulting in detectable fluorescence.

6. The system of claim 3 wherein said propagated light is characterized by a detectable phase and the presence of said pair of binding partners in said depletion area causes a detectable change in the phase of said propagated light.

7. A nanotitre tray comprising a polymer comprising at least one waveguide and a cladding layer comprising at least one well for containing a fluid, said well in optical communication with said waveguide.

Sub A1

8. The tray of claim 7 wherein the tray comprises a plurality of wells, said wells having a volume less than about 50 nanoliters and each of said wells is in optical communication with at least one waveguide.

9. The tray of claim 8 wherein each well is in independent optical communication with a respective separate waveguide.

10. The tray of claim 8 wherein said tray is a flexible film.

11. The tray of claim 8 further comprising at lease one capillary channel in fluid communication with at least one well.

12. The system of claim 2 further comprising a detector for detecting a change resulting from the optical communication of said evanescent wave with said depletion area when said target substance is present.

13. The system of claim 3 wherein said detector is a fluorescent detector for detecting fluorescence when said target substance is present, said fluorescence being selected from the fluorescence which has been optically coupled to said waveguide and fluorescence which is generally orthogonal to the polymer waveguide.

14. The system of claim 3 further comprising at least one capillary channel in fluid communication with said depletion area for conveying said test sample to said depletion area.

15. The system of claim 14 wherein said cladding layer comprises an array of depletion areas in fluid communication with at least one capillary channel and at least one waveguide.

16. The system of claim 15 wherein each of said depletion areas may be individually illuminated with said evanescent wave.

A1

17. The system of claim 4 further comprising a detector capable of detecting fluorescence in either the waveguide or in a direction generally orthogonal to the waveguide.

A1

18. The system of claim 17 wherein said detector is situated on the surface of the waveguide opposing the surface which is optically coupled to the depletion area whereby said

Sub A1

detector detects fluorescence emitted from said depletion area and which travels through said waveguide at an angle greater than that which would result in coupling of said fluorescence with said waveguide.

19. The system of claim 6 wherein said change is selected from fluorescent emission and phase change.

20. The system of claim 6 wherein said change is fluorescence.

21. The tray of claim 8 wherein each well is in optical communication with a common waveguide.

22. A method for detecting the presence of a target substance in a sample comprising the steps of:

providing a detecting system comprising a polymer waveguide capable of optically guiding light propagated therethrough, said light propagation comprising an evanescent wave, and a cladding layer of material comprising at least one depletion area wherein said cladding layer is in optical communication with said polymer waveguide and said depletion area is in optical communication with said evanescent wave;

contacting said sample with said depletion area whereby said target substance, when present interacts with said evanescent wave to cause a detectable change; and

detecting whether said change has occurred.

23. The method of claim 22 wherein said change comprises fluorescence.

24. The method of claim 22 wherein said depletion area comprises a binding partner to said target substance and said method further comprises adding a test reagent comprising a fluorescent label which becomes associated with said target substance when bound to said binding partner.

25. The method of claim 24 wherein said change comprises fluorescence.

26. The system of claim 14 further comprising a microseparation column in fluid communication with said depletion areas whereby the test sample may undergo a separation process prior to entering said depletion area.

27. The system of claim 2 further comprising a protective layer intermediate said cladding layer having at least one depletion area and said polymer waveguide.

28. The system of claim 2 further comprising microfluidics channels for conveying said target substance to said depletion area.

29. The system of claim 27 wherein said depletion area has a refractive index and said waveguide polymer has a refractive index which is different than the refractive index of said depletion area.

30. The system of claim 2 further comprising a light source providing light having a wavelength capable of exciting fluorescent molecules, or having a long wavelength for heating or light which is polarized.

31. The system of claim 27 further comprising a light source providing light having a wavelength capable of exciting fluorescent molecules, or having a long wavelength for heating or light which is polarized.

32. The system of claim 31 wherein the light from the light source is in optical communication with the waveguide and enters the waveguide at an angle whereby total internal reflection can occur.

33. The system of claim 32 wherein the refractive index of the layer containing the depletion area is optimized whereby the evanescent wave enters the depletion area to a predetermined distance.

34. The system of claim 33 wherein the waveguide, protective layer and cladding layer comprise materials respectively chosen for controlling the depth that the evanescent wave penetrates the depletion area.

Sub A1

A1

35. The system of claim 34 wherein the materials comprising the protective layer and cladding layer have thicknesses respectively chosen for controlling the depth that the evanescent wave penetrates the depletion area.

36. A system for detecting the presence of a target substance comprising:

waveguide means having a first refractive index and capable of optically guiding light propagated therethrough, said light propagation comprising an evanescent wave, and

cladding layer means having a second refractive index and comprising at least one depletion area wherein said first refractive index is greater than said second refractive index and said depletion area is in optical communication with said evanescent wave.

37. The system of claim 36 further comprising protective layer means having a third refractive index and located intermediate said waveguide means and said cladding layer means and wherein said third refractive index is lower than said first refractive index and may or may not be the same as said second refractive index.